CLAIM AMENDMENTS

1. (Currently Amended) An actuator comprising:

a fixed iron core unit including first ~~to~~, second, third, and fourth iron cores,

the first iron core having a closed core portion and groovelike channels ~~which are formed~~ between the closed core portion, and a pair of projecting portions extending inward from opposite sides of the closed core portion along an x-axis direction of a Cartesian coordinate system defined by x-, y- and z-axes of the closed core portion,

the second iron core having a closed core portion, and

the third and fourth iron cores individually having split core portions, in which the closed core portions of the first and second iron cores are placed, face-to-face, at a ~~specific~~ fixed distance from each other along ~~the~~ a y-axis direction ~~in such a manner~~ of the Cartesian coordinate system so that ~~they~~ the first and second iron cores overlap each other as viewed along the y-axis direction, the third and fourth iron cores are placed face-to-face with each other, along the x-axis direction, between the first and second iron cores ~~in such a manner~~ so that the split core portions of the third and fourth iron cores together constitute a central closed core portion which overlaps the closed core portions of the first and second iron cores as viewed along the y-axis direction, and the closed core portions of the first and second iron cores and the central closed core portion formed by the split core portions of the third and fourth iron cores together form and surround an armature accommodating space ~~surrounded thereby~~;

an armature unit including an armature made of a magnetic material and first and second rod members attached to the armature; and

a coil including a bobbin and a winding wound around the bobbin, the bobbin having projections extending along ~~the~~ a z-axis direction~~;~~ of the Cartesian coordinate system, wherein

the coil is ~~kept~~ fitted in the groove like channels in the first iron core, preventing the coil from being displaced along the x- and z-axis directions ~~as it is fitted in the groovelike channels formed in the first iron core~~,

~~the coil is kept from being displaced along the y-axis direction as~~ the projections of the bobbin are sandwiched between the first and second iron cores, from ~~both~~ opposite sides along the y-axis direction, preventing the coil from being displaced along the y-axis, and

the armature of ~~said~~ the armature unit is accommodated in the armature accommodating space and supported movably along the z-axis direction by the first and second rod members which are fitted in bearings ~~provided~~ in ~~said~~ the fixed iron core unit.

2. (Currently Amended) An actuator comprising:

a fixed iron core unit including first ~~to~~, second, third, and fourth iron cores, the first and second iron cores individually having closed core portions, and the third and fourth iron cores individually having split core portions, ~~in which~~ the third and fourth iron cores ~~are~~ being placed face-to-face with each other along an x-axis direction of a Cartesian coordinate system defined by x-, y- and z-axes of the closed core portions, between the first and second iron cores ~~in such a manner~~ so that the split core portions of the third and fourth iron cores together constitute a central closed core portion which overlaps the closed core portions of the first and second iron cores, as viewed along ~~the~~ an y-axis direction of the Cartesian coordinate system, and the closed core portions of the first and second iron cores and the central closed core portion formed by the split core portions of the third and fourth iron cores together form and surround an armature accommodating space ~~surrounded thereby~~;

an armature unit including an armature made of a magnetic material and first and second rod members attached to the armature; and

bearings sandwiched between the split core portions of the third and fourth iron cores from ~~both~~ opposite sides along the x-axis direction and held ~~therebetween;~~ between the third and fourth iron cores, wherein

the armature of ~~said~~ the armature unit is accommodated in the armature accommodating space and supported movably along ~~the~~ a z-axis direction of the Cartesian coordinate system by the first and second rod members, which are fitted in ~~said~~ the bearings, and

the armature is ~~caused to move~~ moved from a first position to a second position, and, vice versa, along the z-axis direction ~~by exciting~~ in response to excitation of a coil.

3. (Currently Amended) The actuator according to claim 2, ~~wherein~~ including grooves ~~cut~~ in the x-axis direction ~~are formed~~ in facing end surfaces of the third and fourth iron cores, ~~said~~ wherein

the bearings individually have main portions and projecting portions extending along the x-axis direction from the main portions,

the main portions of ~~said~~ the bearings are sandwiched between the third and fourth iron cores from ~~both~~ opposite sides along the x-axis direction and held therebetween, and

the projecting portions of ~~said~~ the bearings are fitted in the grooves, whereby ~~said~~ the bearings are kept from moving ~~at least~~ along at least one of the y- and z-axis directions.

4. (Currently Amended) The actuator according to claim 3, wherein the grooves extend along at least along one of the y- and z-axis directions, and the projecting portions of ~~said~~ the bearings are fitted in the grooves, whereby ~~said~~ the bearings are kept from moving at least along one of the y- and z-axis directions.

5. (Currently Amended) The actuator according to claim 2, wherein the third and fourth iron cores ~~are formed by laminating~~ include laminated magnetic steel sheets.

6. (Currently Amended) The actuator according to claim 1 further comprising permanent magnets~~;~~ wherein

the projecting portions of the first iron core constitute a pair of projecting magnetic poles extending face-to-face along the x-axis direction from the opposite sides of the closed core portion of the first iron core, leaving a ~~specific~~ gap in between, along the x-axis direction,

the second iron core has a pair of projecting magnetic poles extending face-to-face along the x-axis direction from opposite sides of the closed core portion of the second iron core, leaving a ~~specific~~ gap in between, along the x-axis direction,

the third and fourth iron cores individually have projecting magnetic poles extending along the x-axis direction from inside surfaces of the split core portions,

the projecting magnetic poles of the first and second iron cores on ~~one~~ a first side and the projecting magnetic pole of the third iron core together constitute an opposing magnetic pole, and

the projecting magnetic poles of the first and second iron cores on the ~~other~~ a second side and the projecting magnetic pole of the fourth iron core together constitute another opposing magnetic pole; and

~~wherein said~~ the permanent magnets are ~~provided~~ located between the opposing magnetic poles and the armature and affixed to the opposing magnetic poles or the armature, and the armature is held at a first position and a second position along the z-axis direction by magnetic forces produced by the permanent magnets and ~~caused to move~~ moved from the first position to the second position, and, vice versa, along the z-axis direction ~~by exciting~~ in response to excitation of the coil.

7. (Currently Amended) The actuator according to claim 6, wherein the permanent magnets are embedded in recesses ~~formed~~ in the armature and affixed thereto ~~in such a manner~~ so that the permanent magnets ~~become~~ are flush with surfaces of the armature.

8. (Original) The actuator according to claim 6 further comprising support plates fixed to the armature or the opposing magnetic poles, each of the support plates covering a surface of each permanent magnet, whereby the support plates can slide along the armature or the opposing magnetic poles.

9. (Currently Amended) The actuator according to claim 8, wherein both ends of each of the support plates are oppositely extended along the z-axis direction, forming extended portions which are curved ~~in such a direction~~ so that the extended portions grip each of the permanent magnets.

10. (Currently Amended) The actuator according to claim 6, wherein ~~said~~ the bearings are sandwiched between the split core portions of the third and fourth iron cores, from ~~both~~ opposite sides, along the x-axis direction and held therebetween.

11. (Currently Amended) The actuator according to claim 10, wherein grooves ~~cut~~ in the x-axis direction are ~~formed~~ in facing end surfaces of the third and fourth iron cores, ~~said~~ the bearings individually have main portions and projecting portions, the main portions of ~~said~~ the bearings are sandwiched between the third and fourth iron cores from ~~both~~ opposite sides along the x-axis direction and held therebetween, and the projecting portions of ~~said~~ the bearings are fitted in the grooves, whereby ~~said~~ the bearings are kept from moving along the z-axis direction.

12. (Original) The actuator according to claim 10, wherein the armature accommodating space permits the permanent magnets to be inserted between the opposing magnetic poles and the armature along the y-axis direction.

13. (Currently Amended) The actuator according to claim 1, wherein said fixed iron core unit includes a fifth iron core and a permanent magnet, the fifth iron core being ~~provided on the~~ outside of at least one of the closed core portions of the first and second iron cores, with an end of the fifth iron core disposed face-to-face with the armature along the y-axis direction, the fifth iron core constituting part of a magnetic circuit ~~in~~ through which a magnetic flux passes from ~~said~~ the one of the closed core portions through ~~the interior of~~ the armature along ~~its~~ a moving direction of the armature and returns to ~~said~~ the one of the closed core portions, ~~and~~ the permanent magnet being provided in the magnetic

circuit, and ~~wherein~~

the armature is held at a first position and a second position along the z-axis direction by a magnetic force produced by the permanent magnet and ~~caused to move~~ moved from the first position to the second position, and, vice versa, along the z-axis direction ~~by exciting~~ in response to excitation of the coil.

14. (Currently Amended) The actuator according to claim 1, wherein the armature has a through hole ~~formed~~ through itself along the z-axis direction and an internally threaded portion ~~formed at about the middle~~ located approximately centrally of the through hole, and the first and second rod members each have a shank portion having a smooth surface and an externally threaded portion ~~which is screwed into~~ engaging the internally threaded portion of the through hole in the armature, whereby one end of the first rod member and one end of the second rod member are held in contact with each other.

15. (Original) The actuator according to claim 14, wherein the shank portions of the first and second rod members are in direct contact with an inside surface of the through hole in the armature and supported thereby.

16. (Original) The actuator according to claim 14, wherein the first and second rod members are made of a nonmagnetic material.

17. (Currently Amended) The actuator according to claim 1, wherein at least one of the armature and the first ~~to~~, second, third, and fourth iron cores ~~is formed by laminating~~ includes laminated magnetic steel sheets.

18. (Original) A method of manufacturing an actuator which comprises:

a fixed iron core unit including first to fourth iron cores, the first iron core having a closed core portion and groovelike channels which are formed between the closed core portion and a pair of projecting portions extending inward from opposite sides of the closed core portion along an x-axis direction of a Cartesian coordinate system defined by x-, y- and z-axes of the closed core portion, the second iron core having a closed core portion, and the third and fourth iron cores individually having split core portions, in which the closed core portions of the first and second iron cores are placed face to face at a specific distance from each other along the y-axis direction in such a manner that they overlap each other as viewed along the y-axis direction, the third and fourth iron cores are placed face to face with each

other along the x-axis direction between the first and second iron cores in such a manner that the split core portions of the third and fourth iron cores together constitute a central closed core portion which overlaps the closed core portions of the first and second iron cores as viewed along the y-axis direction, and the closed core portions of the first and second iron cores and the central closed core portion formed by the split core portions of the third and fourth iron cores together form an armature accommodating space surrounded thereby;

an armature unit including an armature made of a magnetic material and first and second rod members attached to the armature;

coils each including a bobbin and a winding wound around the bobbin, the bobbin having projections extending along the z-axis direction; and

permanent magnets;

wherein the coils are kept from being displaced along the x- and z-axis directions as they are fitted in the groovelike channels formed in the first iron core, the coils are kept from being displaced along the y-axis direction as the projections of the bobbins are sandwiched between the first and second iron cores from both sides along the y-axis direction, and the armature of said armature unit is accommodated in the armature accommodating space and supported movably along the z-axis direction by the first and second rod members which are fitted in bearings provided in said fixed iron core unit;

wherein the projecting portions of the first iron core constitute a pair of projecting magnetic poles extending face to face along the x-axis direction from the opposite sides of the closed core portion of the first iron core leaving a specific gap in between along the x-axis direction, the second iron core has a pair of projecting magnetic poles extending face to face along the x-axis direction from opposite sides of the closed core portion of the second iron core leaving a specific gap in between along the x-axis direction, the third and fourth iron cores individually have projecting magnetic poles extending along the x-axis direction from inside surfaces of the split core portions, the projecting magnetic poles of the first and second iron cores on one side and the projecting magnetic pole of the third iron core together constitute an opposing magnetic pole, and the projecting magnetic poles of the first and second iron cores on the other side and the projecting magnetic pole of the fourth iron core together constitute another opposing magnetic pole;

wherein said permanent magnets are provided between the opposing magnetic poles and the armature and affixed to the opposing magnetic poles or the armature, and the armature is held at a first position and a second position along the z-axis direction by magnetic forces produced by the permanent magnets and caused to move from the first position to the second position, and vice versa, along the z-axis direction by exciting the

coils;

wherein said bearings are sandwiched between the split core portions of the third and fourth iron cores from both sides along the x-axis direction and held therebetween; and

wherein the armature accommodating space permits the permanent magnets to be inserted between the opposing magnetic poles and the armature along the y-axis direction;

said method comprising the steps of:

attaching the first and second rod members to the armature;

passing the coils and the bearings over the first and second rod members;

sandwiching the bearings by the third and fourth iron cores from both sides along the x-axis direction to hold the bearings in position;

sandwiching the projections of the bobbins of the coils by the first and second iron cores to keep the coils from being displaced along the y-axis direction;

inserting said permanent magnets into the armature accommodating space along the y-axis direction and fixing said permanent magnets to the opposing magnetic poles or the armature.

19. (Currently Amended) A circuit breaker comprising:

the actuator according to claim 6; and

a switching device ~~of which~~ having contacts ~~are~~ opened and closed by the actuator, with one of the contacts connected to the first or second rod member of the actuator.